Rolling Stones: Haleakalā National Park Rocks!

Next Generation Science Standards:

- 4-ESS1-1 Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.
- 4-ESS2-1 Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
- 4-ESS2-2 Analyze and interpret data from maps to describe patterns of Earth's features.
- 5-ESS2-1 Develop a model using an example to describe ways the geosphere, biosphere, hydrosphere, and/or atmosphere interact.

Hawai'i Content and Performance Standards III:

- SC.4.8.1 Describe how slow processes sometimes shape and reshape the surface of the Earth.
- SC.5.2.1 Use models and/or simulations to represent and investigate features of objects, events, and processes in the real world.

Description:
This lesson explores the forces of weathering and erosion that shape our island home. It recounts volcanic creation, and then delves into the gradual destruction caused by the forces of wind, water, ice and waves.

Duration: 60 minutes

Objectives: At the end of this lesson, the students will be able to:

- Describe the impacts of deposition, weathering, and erosion on landforms.

Background:
The Earth is undergoing continuous change by weathering and erosion. As rocks are weathered (broken down into smaller pieces) and eroded (moved to new locations) the landscape is gradually transformed. The Hawaiian Islands are on a journey as they travel along toward the northwest on the pacific plate. As they move further and further from the hot spot, the volcanic activity stops, and the forces of weathering and erosion take over.

Haleakalā National Park contains a great erosional depression which is commonly referred to as the "crater". Visitors flock by the millions every year to witness the sunrise, sunsets, and to hike deep into this majestic erosional depression. It is a land of harsh extremes, where the forces of nature are on display for all to see and to feel.

Vocabulary:
Erosion: A process where worn down rocks are carried away by gravity.
Weathering: A process where rocks are broken down by ice, water, wind, and rain into dirt.

Materials Needed:
Internet connection to view map of Hawaiian archipelago:
http://www.papahanaumokuakea.gov/education/pdf/pmnm_map_poster.pdf
Life Cycle of the Hawaiian Islands Worksheet (included)
Life Cycle of the Hawaiian Islands Worksheet Teacher Answer Key (included)
Blank paper for Artwork Time Machine Activity

Procedure:

Step 1: Review the creation of the Hawaiian Islands

Briefly review with students how Hawai'i was formed as it slowly passed over the hotspot.

Step 2: Weathering

The Hawaiian Islands are giant volcanoes that built up from the ocean floor in the middle of the Pacific Plate. For example, Haleakalā is about 28,000 feet tall! About 18,000 feet of it is underwater, while 10,023 feet are above sea level. Geologists think that it was once 3,000-6,000 feet taller than it is now. What happened?

- What is wearing the island down?
- Ask students to name what things that cause the weathering of Maui.
- List them on the board.
    - Tropical Rains
    - Constant trade winds
    - Storms
    - Waves
    - Tsunamis
    - Hurricanes
    - Ice-freezing and thawing at summit
- Why are the Northwest Hawaiian Islands so small? = They are being weathered and eroded.
- Are they sinking? = Yes, from the volcanoes own weight!
- Is Maui still getting smaller? Why?

Step 3: Erosion

Explain that weathering breaks the rocks down but when gravity moves those worn down rocks away it is called erosion. Discuss the effects of weathering and erosion on the land.

- Ask students to name some of the landforms caused by this weathering. List them on the board.
    - Valleys
    - Rivers and streams
    - Gulches/dry stream beds

    - Mudslides and landslides
    - Pali or cliffs
- Ask students to provide some specific places they have seen erosion. = Iao valley, Haleakalā, Hāna highway.
- What other forces are there affecting our landscape? = Earthquakes, floods, fire, and human impacts.

Step 4: Relate Weathering and Erosion to the Hawaiian Islands

Has anyone ever visited the Big Island?
Did you notice anything about the land on the Big Island of Hawai'i?
Has anyone ever visited Kauai? What did you notice about Kaua'i?
Does Kaua'i seem more worn down than Hawai'i?
Does it seem more worn down than Maui?
What do you think the islands look like as they move further and further away from the hot spot over thousands and millions of years?
Discuss the fact that Hawai'i is part of a chain of 132 volcanic islands that are in various stages of weathering and erosion. See the map of all the Hawaiian Islands on the Papahanaumokuakea Marine National Monument webpage: http://www.papahanaumokuakea.gov/education/pdf/pmnm_map_poster.pdf

Step 5: Life Cycle of the Hawaiian Islands Worksheet

Hand out the worksheet and explain that these maps are like snapshots of the exact same location over many millions of years. Instruct students to number the 6 snapshots from 1-6 with 1 being the newest and 6 the oldest. Use the key at the bottom of the page to understand the time frame for each number. There is a Teacher Answer Key provided. Go over together as a class. Students can also cut out the squares and put them in chronological order.

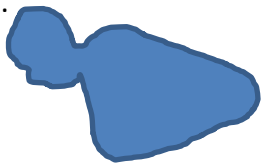
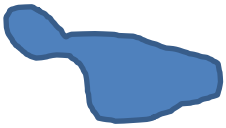
Discuss some of the names of the unfamiliar islands that have moved far to the Northwest on the moving Pacific Plate. It's amazing to think that over the ages, that each of these different islands were once where the Big Island is today.

Step 6: Artwork Time Machine Activity

Ask students make 4 boxes on a piece of paper and number them 1-4. Let the students know that they will be entering a magical time machine that lets us live and travel in time for 10 million years! We will be making a few stops in our time machine to stop and draw Maui.

- In Box 1: Have the students draw the outline of Maui today.
- In Box 2: Draw the outline of Maui 1 million years from now.
- In Box 3: Draw the outline of Maui 5 million years from now.
- In Box 4: Draw the outline of Maui 10 million years from now.

Teacher Answer Key

1. 	2. 
3. 	4. All underwater, sorry!

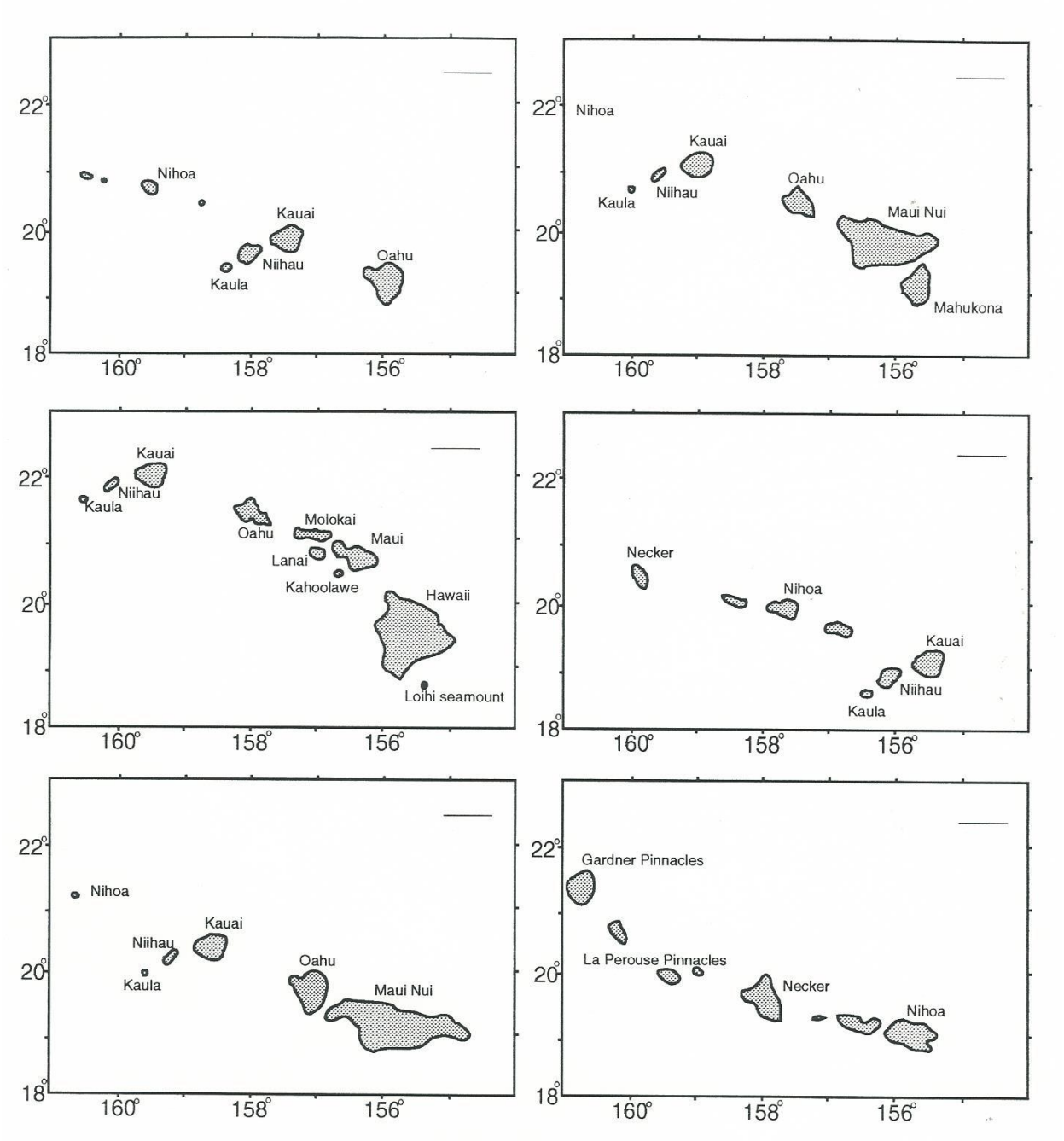
Have the students share with each other what their predictions were for how Maui might look at these different time periods. Could Maui grow some more before it continues on its path to the northwest on the Pacific Plate? Or is it eroding and shrinking?

Step 7: Conclusion

We all live on land that is made of rocks and geologic features. Would we have soil without rocks? Would we have plants without soil? Now that you realize how important geology is to living things. The type of rock that is found in an area tells the story of how that place was formed as well as what forces are breaking it back down. Like many processes the rocks around us are part of a great cycle, one of creation, transformation and destruction. If you know how to read them (or listen to them), rocks can tell an observant scientist about what a place looked like millions of years ago. Geologists are rock detectives who discover clues to the ancient past.

Reference: Adapted from Mattox, S. (1994). *A teacher's guide to the geology of Hawaii Volcanoes National Park.* (Activity 4.7). Honolulu, HI: Hawai'i Natural History Association.

Life Cycle of the Hawaiian Islands

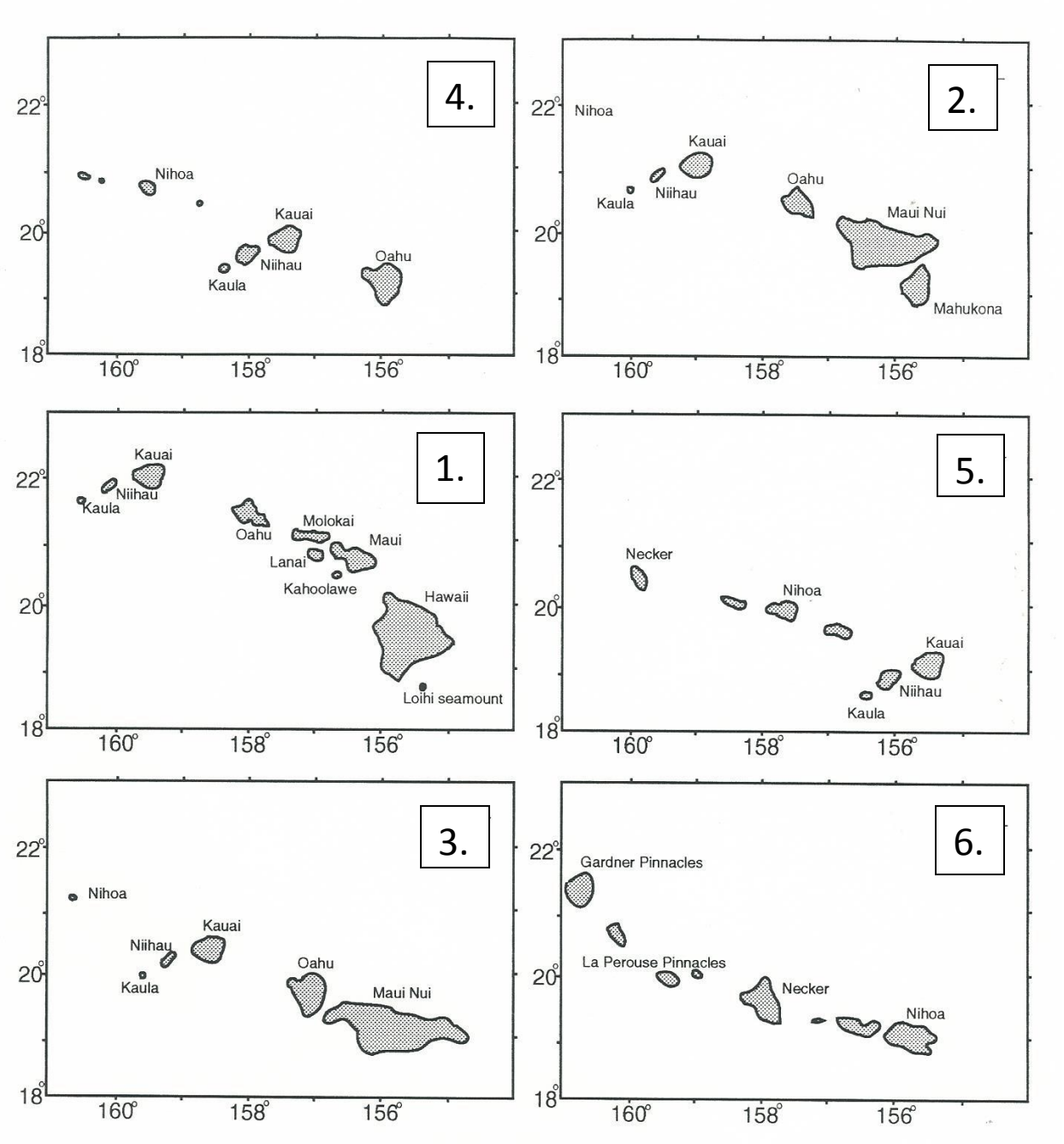


Label each map from 1-6 with the proper time frame:

1. = Present time
2. = 500,000 years ago
3. = 1,000,000 years ago
4. = 2,500,000 years ago
5. = 5,000,000 years ago
6. = 7,500,000 years ago

Adapted from Mattox (1994) Activity 4.7

Life Cycle of the Hawaiian Islands Teacher Answer Key



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Adapted from Mattox (1994) Activity 4.7